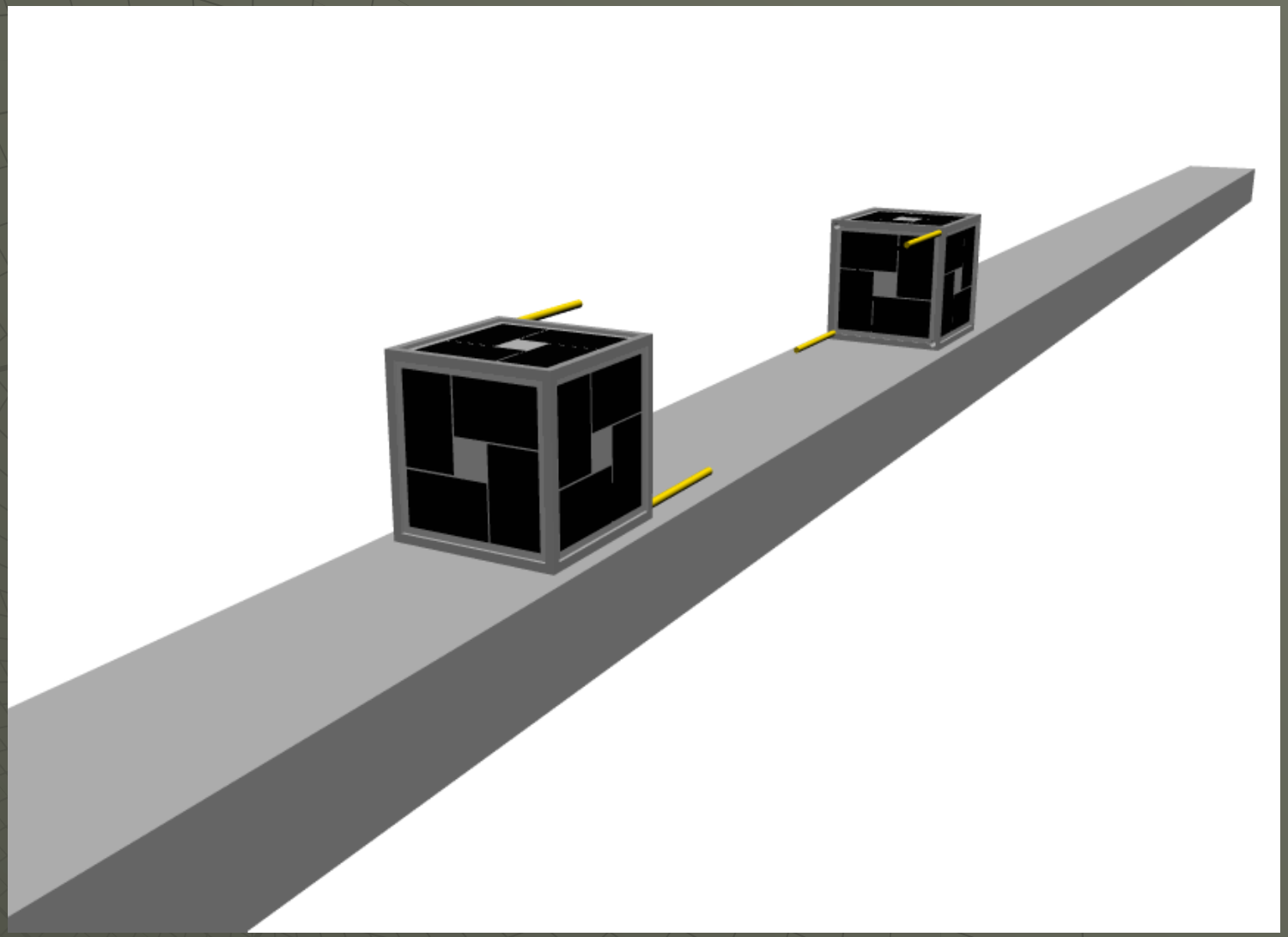
Deployment Test & Demonstration



Calculations

Initial Conditions:

$m_{RAFT} = 4kg \quad v_{Launch} = 1.5\,m/s$

$m_{MARS} = 3kg \quad k_{Spring} = 183.8\,N/m$

$x = 4in = 0.1016m$

Energy in Separation Springs:

$$PE = \frac{1}{2}k_{spring}x^2$$

in one spring:

$$PE_{one} = \frac{1}{2}\left(183.8\,N/m\right)\left(0.1016m\right)^2 = 0.9486J$$

in four springs:

$$PE_{Total} = 4PE_{one} = 4\left(0.9486J\right) = 3.795J$$

Separation Relative Velocity:

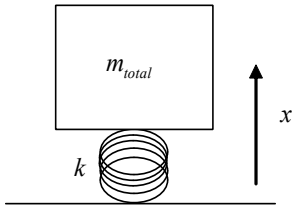
$$\sum E_{initial} = \sum E_{Final}$$

$$PE_{initial} + \cancel{KE_{initial}} = \cancel{PE_{final}} + KE_{final}$$

$$PE_{Total} = \frac{1}{2}m_{total}v_{rel}^{\ 2}$$

$$3.795J = \frac{1}{2}\left(m_{RAFT} + m_{MARS}\right)v_{rel}^{\ 2} = \frac{1}{2}\left(4kg + 3kg\right)v_{rel}^{\ 2}$$

$$\Rightarrow v_{rel} = 1.041\,m/s$$



Final Velocities Relative to Shuttle

MARScom:

$$v_{final} = v_{initial} + \left(\frac{m_{RAFT}}{m_{Total}}\right)v_{rel}$$

$$v_{final} = 1.5\,m/s + \left(\frac{4kg}{7kg}\right)\left(1.041\,m/s\right)$$

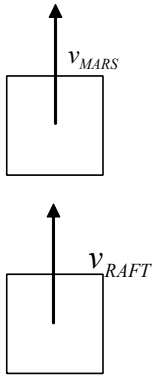
$$v_{final} = 2.095\,m/s$$

RAFT:

$$v_{final} = v_{initial} - \left(\frac{m_{MARS}}{m_{Total}}\right)v_{rel}$$

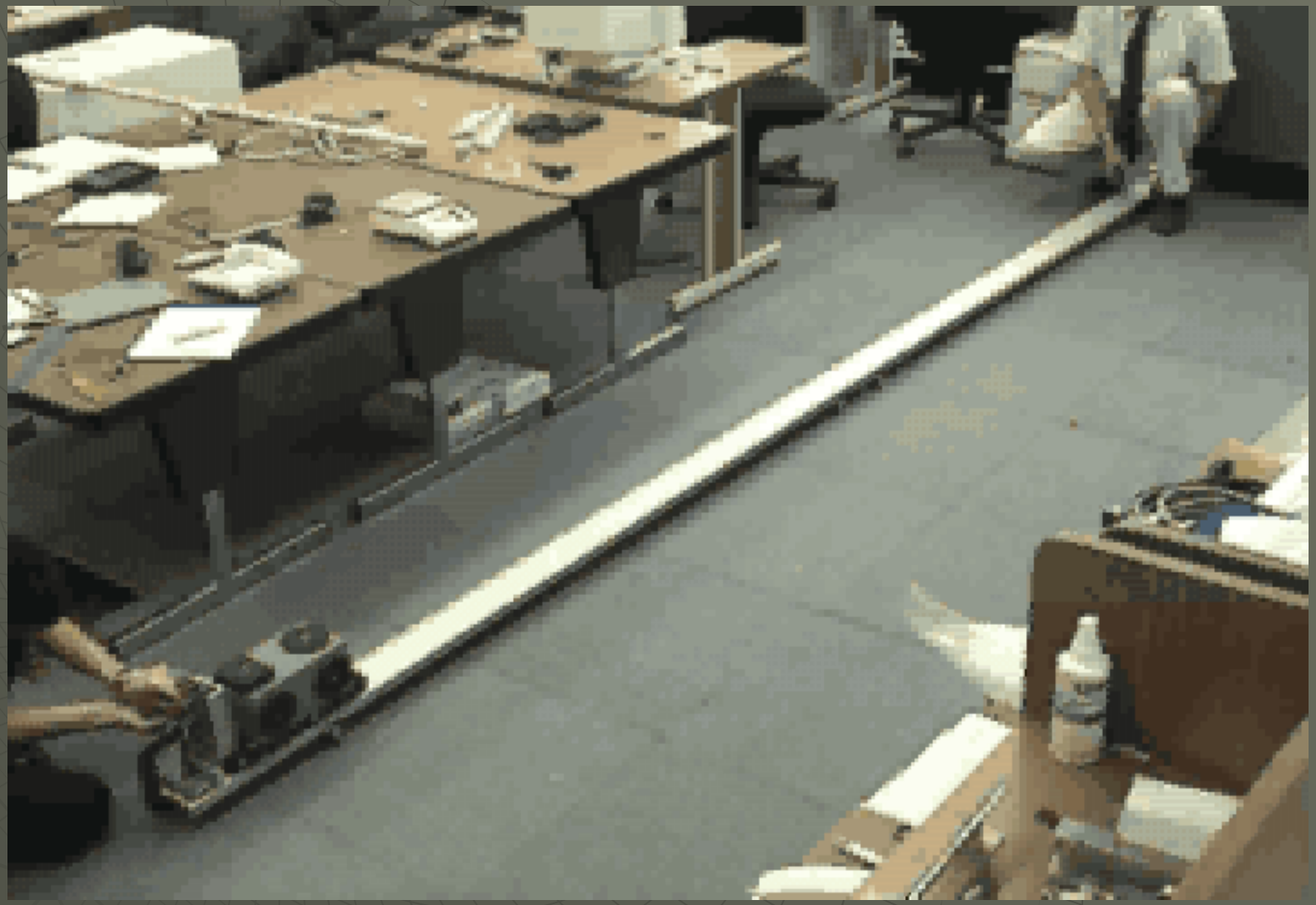
$$v_{final} = 1.5\,m/s - \left(\frac{3kg}{7kg}\right)\left(1.041\,m/s\right)$$

$$v_{final} = 1.054\,m/s$$



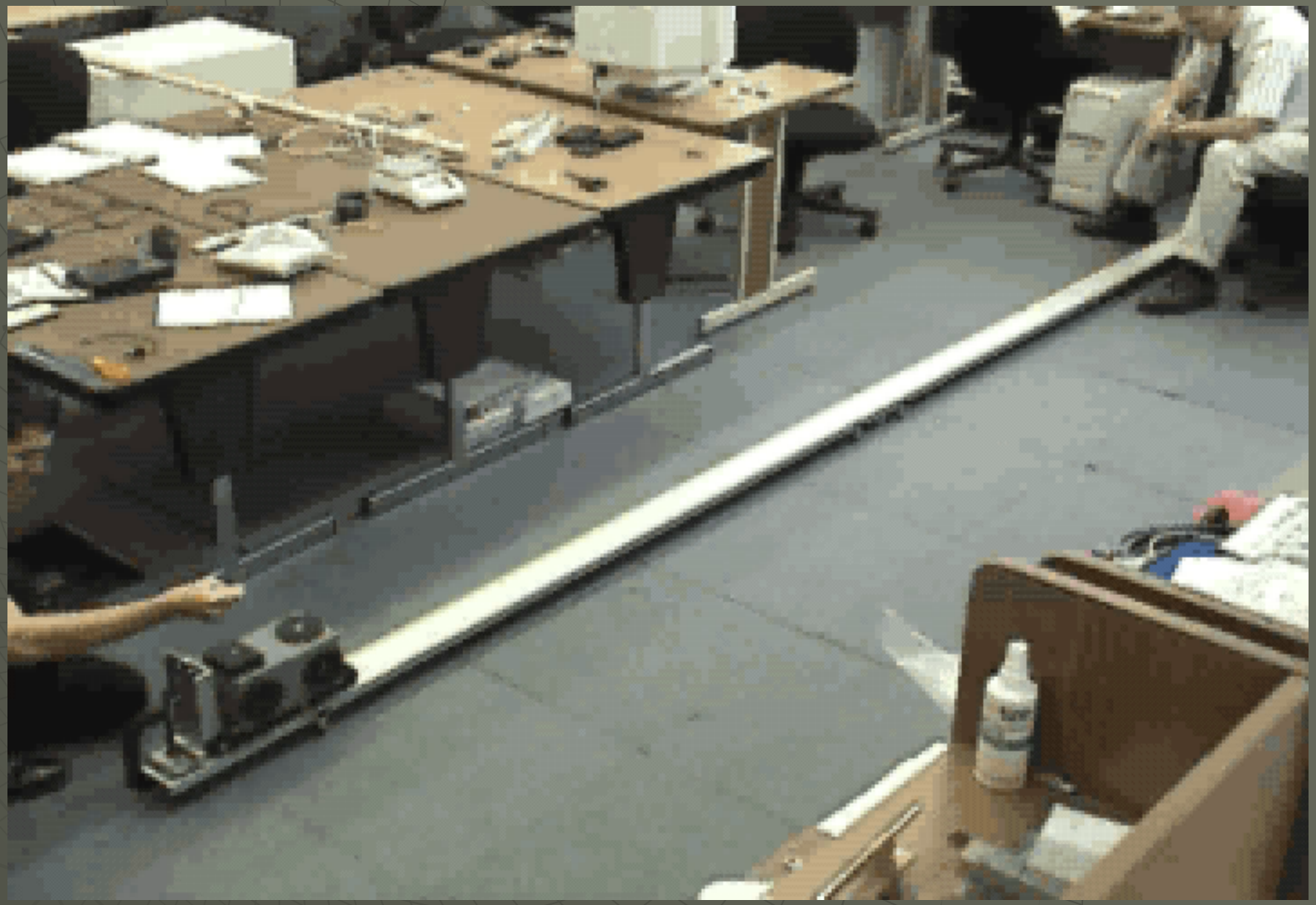
Air Track Separation Test
Phase 1

Air Track Separation Test
Phase 1



Air Track Separation Test
Phase 2

Air Track Separation Test
Phase 2



RAFT Launch Final Concept